# SERVICE MANUAL

## MINARELLI V1 ENGINE

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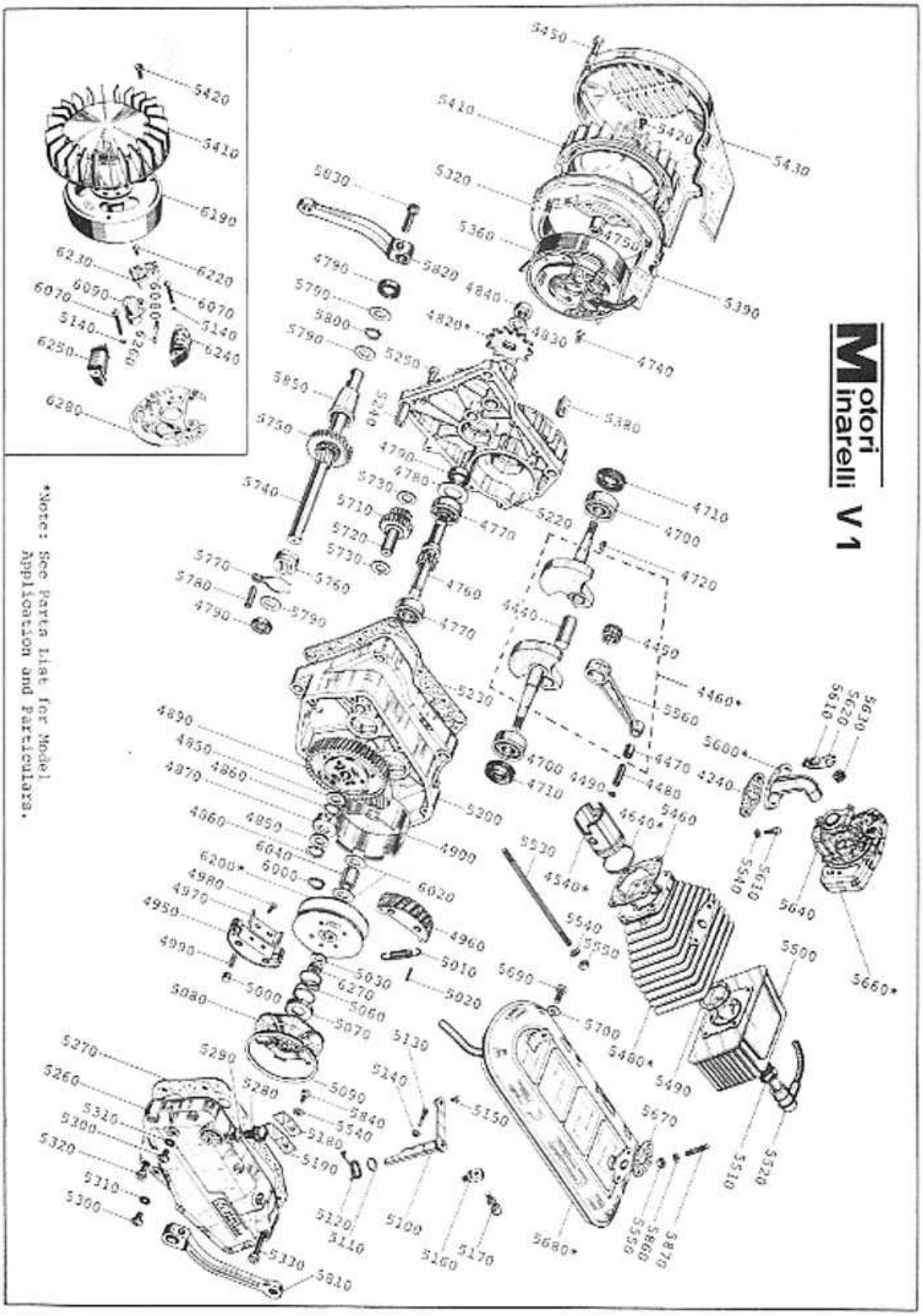

Motori Minarelli V1
*Note: See Parts List for Model Application and Particulars.

## TABLE 1 MINARELLI ENGINE

| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| 4240 | 1 | Gasket for Carburetor Intake Manifold |
| 4410 | 1 | Crankshaft, Complete, STUB PLANE |
| 4420* | 1 | Half-shaft, Clutch Side, STUB PLANE |
| 4430* | 1 | Half Shaft, Flywheel Side, STUB PLANE |
| 4440 | 1 | Connecting Pin, Ø16mm w/o Hole |
| 4450 | 1 | Roller Bearing Ø16 x 22 x 12mm |
| 4460 | 1 | Crankshaft Assembly, Complete, CONE |
| 4470 | 1 | Bushing, Ø12 x 13mm for Connecting Rod |
| 4480 | 1 | Piston Pin, Ø12 x 31.5mm |
| 4490 | 2 | Stop Ring for Piston Pin |

* Available only in complete Assembly (#4410)

| | | |
|---|---|---|
| | | 20 MPH ENGINE<br>Pistons w/Parts 4480, 4490 and Rings |
| 4500 | 1 | Standard Ø38.0mm |
| 4510 | 1 | Oversize Ø38.2mm |
| 4520 | 1 | Oversize Ø38.4mm |
| 4530 | 1 | Oversize Ø38.6mm |
| | | 25/30 MPH ENGINE<br>Pistons w/Parts 4480, 4490 and Rings |
| 4540 | 1 | Standard Ø38.8mm |
| 4550 | 1 | Oversize Ø39.0mm |
| 4560 | 1 | Oversize Ø39.2mm |
| 4570 | 1 | Oversize Ø39.4mm |
| 4580 | 1 | Oversize Ø39.6mm |
| 4590 | 1 | Oversize Ø39.8mm |
| | | RINGS FOR 20 MPH ENGINE |
| 4600 | 2 | Standard Ø38 x 2.5 x 1.5mm |
| 4610 | 2 | Oversize Ø38.2mm |
| 4620 | 2 | Oversize Ø38.4mm |
| 4630 | 2 | Oversize Ø38.6mm |

**TABLE 1 MINARELLI ENGINE**

| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| | | RINGS FOR 25/30 MPH ENGINE |
| 4640 | 2 | Standard Ø38.8 x 2.5 x 1.5mm |
| 4650 | 2 | Oversize Ø39.0mm |
| 4660 | 2 | Oversize Ø39.2mm |
| 4670 | 2 | Oversize Ø39.4mm |
| 4680 | 2 | Oversize Ø39.6mm |
| 4690 | 2 | Oversize Ø39.8mm |

NOTE: Beginning January 1, 1978 all V1 engines produced will be 49.4 cc for the 1.9 HP model. The following parts apply to this new model.

| | | |
|---|---|---|
| 4535 | 1 | Standard 38.7 Piston |
| 4635 | 1 | Standard 38.7 Ring |
| 5475 | 1 | Cylinder 38.7mm Cast Iron |

NOTE: The oversizes for the 38.7mm Piston and Rings are Ø38.8 - Ø39 - Ø39.2 - Ø39.4 - Ø39.6 - Ø39.8

## TABLE 1 MINARELLI ENGINE

| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| 4700 | 2 | Bearing for Ø11 x 40 x 12mm, RIV 01 |
| 4710 | 2 | Seal for Crankshaft, Ø17 x 35 x 8mm |
| 4720 | 1 | Key for Magneto Flywheel (CEV) |
| 4730 | 1 | Key for Magneto Flywheel (BOSCH) |
| 4740 | 3 | Screw for Securing Stator, TCB 4 MA x 10mm |
| 4750 | 1 | Check Nut for Magneto Flywheel |
| 4760 | 1 | Drive Shaft |
| 4770 | 2 | Bearing Ø15 x 35 x 11mm RIV 02A |
| 4780 | 1 | Shim for Bearing, Ø35mm |
| 4790 | 3 | Oil Seal, Ø15 x 24 x 5mm |
| 4800 | 1 | Sprocket, Intermediate for 9T for 20mph |
| 4810 | 1 | Sprocket, Intermediate for 10T for 25mph Z-10 Engine |
| 4820 | 1 | Sprocket, Intermediate for 11T for 30mph |
| 4830 | 1 | Washer for Nut Ø10mm x 0.8mm thickness |
| 4840 | 1 | Nut for Intermediate Sprocket |
| 4850 | 2 | Shim, Ø15 x 21mm |
| 4860 | 2 | Snap Ring for Shaft, Ø15mm |
| 4870 | 1 | Drive Clutch |
| 4880 | 1 | Gear Set, Complete w/ Parts 4890 & 4900 |
| 4890 | 1 | Gear for Clutch w/Plate, z-53 |
| 4900 | 7 | Engine Sprocket w/Housing, z-15 |
| 4910 | 2 | Shim, Ø13 x 21mm, STUB PLANE |
| 4920 | 1 | Bushing for Clutch, STUB PLANE |
| 4930 | 1 | Clutch, Centrifugal, Complete, STUB PLANE |
| 4940 | 1 | Bearing for Clutch Shoe, STUB PLANE |
| 4950 | 2 | Clutch Shoe |
| 4960 | 2 | Clutch Shoe, Complete w/Parts 4970 & 4980 |
| 4970 | 2 | Plate for Clutch Shoe |
| 4980 | 2 | Screw for Securing Plate, TSP 4 MA x 12mm |
| 4990 | 4 | Spring for Brake Pad |
| 5000 | 4 | Brake Pad |
| 5010 | 2 | Return Spring for Clutch Shoe |
| 5020 | 4 | Pin for Securing Spring |
| 5030 | 1 | Washer for Brake Shoe Bearing Nut |
| 5040 | 1 | Locknut for Brake Shoe Bearing, STUB PLANE |
| 5050 | 1 | Cotter Pin for Nut, STUB PLANE |
| 5060 | 1 | Cap Return Spring |
| 5070 | 1 | Retainer for Cap Return Spring |
| 5080 | 1 | Retainer Cap for Starter |
| 5090 | 1 | Lock Ring for Cap |
| 5100 | 1 | Lever for Clutch |

## TABLE 1 MINARELLI ENGINE

| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| 5110 | 1 | Grommet for Clutch Lever |
| 5120 | 1 | Return Spring for Clutch Lever |
| 5130 | 1 | Set Screw for Clutch Lever |
| 5140 | 1 | Washer, Ø4mm. CEV |
| 5150 | 1 | Bolt for Securing Clutch, 5 MA x 8mm |
| 5160 | 1 | Bridge for Clutch Adjuster |
| 5170 | 1 | Clutch Lever Adjuster |
| 5180 | 1 | Spring Leaf, Upper |
| 5190 | 1 | Spring Leaf, Lower |
| 5200 | 1 | Half-Casing, Clutch Side |
| 5210 | 1 | Half-Casing, Flywheel Side, for Stator Ø E.94 |
| 5220 | 1 | Half-Casing, Flywheel Side, for Stator Ø E.80 |
| 5230 | 1 | Gasket for Half-Casing, Center |
| 5240 | 3 | Dowel for Crankcase, Ø10 x 40mm |
| 5250 | 11 | Bolt, TCCE 6 MA x 30mm |
| 5260 | 1 | Cover, Clutch Side |
| 5270 | 1 | Gasket for Clutch Cover |
| 5280 | 1 | Cap, Oil Feed |
| 5290 | 1 | Gasket for Cap, Ø12mm |
| 5300 | 2 | Bolt, TCB 6 MA for Oil Level and Drain |
| 5310 | 2 | Gasket for Bolt, Ø6mm |
| 5320 | 3 | Bolt, TCCE 6 MA x 15mm |
| 5330 | 6 | Bolt, TCCE 6 MA x 35mm |
| 5340 | 1 | Magneto Flywheel, Complete, 23W - 6V, w/External High Voltage Coil, Stator Ø94mm (CEV Model 6876) |
| 5350 | 1 | Magneto Flywheel, Complete, 18W - 6V, w/Internal High Voltage Coil,Stator Ø80mm (Bosch KB6-B212) |
| 5360 | 1 | Magneto Flywheel, Complete, 23W - 6V, w/External High Voltage Coil, Stator Ø80mm (CEV Model 6932) |
| 5370 | 1 | Wire Guide on Crankcase for Internal High Voltage Coil |
| 5380 | 1 | Wire Guide on Crankcase for External High Voltage Coil |
| 5390 | 1 | Bearing, for Aluminum Air conveyor only |
| 5400 | 1 | Bearing, for Plastic Air conveyor only |
| 5410 | 1 | Cooling Fan |
| 5420 | 4 | Bolt, TCS, 4 MA x 10mm for securing Fan |
| 5430 | 1 | Air Conveyor, Aluminum |
| 5440 | 1 | Air Conveyor, Plastic |
| 5450 | 3 | Bolt, TCCE, 6 MA x 25mm |
| 5460 | 1 | Gasket for Cylinder Base |
| 5470 | 1 | Cylinder, Ø38mm, Cast Iron, Model 30km for 20mph |

## TABLE 1 MINARELLI ENGINE

| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| 5480 | 1 | Cylinder, Ø38.8 mm, Cast Iron, for 25/30mph and Z-10 Engine |
| 5490 | 1 | Gasket for Cylinder Head STD 0.7mm |
| 5500 | 1 | Engine Head |
| 5510 | 1 | Spark Plug, Bosch W 145 TI or Equivalent |
| 5520 | 1 | Cover for Spark Plug, Rubber Ø6 |
| 5530 | 4 | HOLD DOWN STUD, 6 MA x 136mm for Cylinder Head |
| 5540 | 5 | Washer, Chamfered 06mm |
| 5550 | 6 | Nut for Stud Bolt, 6 MA x 6mm |
| 5580 | 1 | Side Carburetor Manifold Ø12mm for 30mph and Z-10 Engine |
| 5590 | 1 | Side Carburetor Manifold Ø8.5 mm for 25/30mph |
| 5600 | 1 | Side Carburetor Manifold Ø7.25mm for 20 mph |
| 5610 | 1 | Bolt, 6 MA x 16 mm for Securing Cover |
| 5620 | 1 | Wire Guide for Spark Plug Wire |
| 5630 | 1 | Grommet for Spark Plug Wire, Rubber |
| 5640 | 1 | Carburetor, SHA 14-9, Max. Jet #49 Dell'Orto for 20mph |
| 5650 | 1 | Carburetor, SHA 14-12, Max. Jet #52 Dell'Orto for 25/30mph |
| 5660 | 1 | Filter Housing Supported by Clamp |
| 5670 | 1 | Gasket for Muffler |
| 5680 | 1 | Muffler, Type "M" Short (below engine) |
| 5690 | 1 | Bolt, 7 MA x 20mm, for Securing Muffler |
| 5700 | 1 | Washer, Chamfered, Ø7mm |
| 5710 | 1 | Idler, z-16, 21 Teeth |
| 5720 | 1 | Pin, 12 x 46mm, for Idler |
| 5730 | 2 | Shim, Ø12 x 17mm |
| 5740 | 1 | Shaft for Pedal |
| 5750 | 1 | Gear, z-27, for Pedal |
| 5760 | 1 | Clutch for Pedal, Sliding (Hgt. 11mm) |
| 5770 | 1 | Spring for Sliding Clutch |
| 5780 | 1 | Guide Pin for Spring, Ø8.5 x 24mm |
| 5790 | 3 | Shim, Ø16mm |
| 5800 | 1 | Lock Ring, Ø16mm, for Pedal Shaft |
| 5810 | 1 | Crank for Right Pedal (marked with a "D") |
| 5820 | 1 | Crank for Left Pedal |
| 5830 | 2 | Pin for Crank, Complete w/Nut and Washer |
| 5840 | 1 | Bolt, 6 MA x 12mm, for Securing Leaves |
| 5850 | 1 | Cap for Pedal Shaft |
| 5860 | 2 | Lock Washer, Ø6mm |
| 5870 | 2 | Stud Bolt, 6 MA x 23mm, for Muffler |
| 5880 | 1 | Clamp for Securing Filter Housing "S-1" |

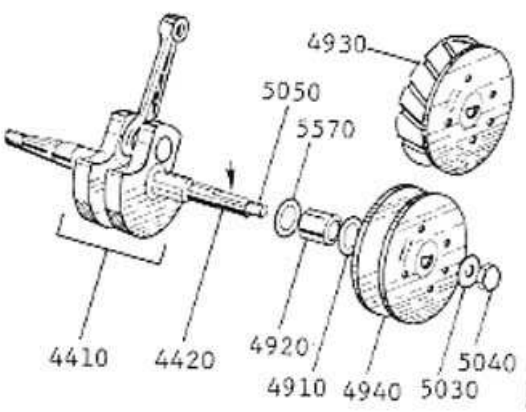
## TABLE 1 MINARELLI ENGINE

| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| 5890 | 1 | Gasket Set, Complete w/ 5230, 5270, 5460, 5490, 4240, and 5670 |
| 6000 | 2 | Snap Ring for Shaft Ø14mm, CONE |
| 6020 | 2 | Shim, Ø14 x 20mm, CONE |
| 6040 | 1 | Bushing for Clutch, CONE |
| 6180 | | Clutch, Centrifugal, Complete, CONE |
| 6200 | 1 | Bearing for Clutch Shoe, CONE |
| 6270 | 1 | Locknut for Brake Shoe Bearing, CONE |
| 7050 | 4 | Screws for plastic air conveyor |

## TABLE 2 CLUTCH FOR MINARELLI ENGINE

| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| 4410 | 1 | Complete Crankshaft Assembly, S.P. |
| 4420 | 1 | Half Shaft Clutch Side, S.P. |
| 4460 | 1 | Complete Crankshaft Assembly, CONE |
| 4910 | 1 | Shim 13 x 21mm |
| 4920 | 1 | Bushing for Clutch |
| 4930 | 1 | Complete Centrifugal Clutch, S.P. |
| 4940 | 1 | Bearing for Clutch, S.P. |
| 5030 | 1 | Washer for Nut |
| 5040 | 1 | Locknut for Brake Shoe Bearing |
| 5050 | 1 | Cotter Pin for Nut |
| 5570 | 1 | Shim 13.7 x 20.8 S.P. |
| 6000 | 1 | Snap Ring for Shaft - CONE |
| 6020 | 2 | Shim 14 x 20 - CONE |
| 6040 | 1 | Bushing for Clutch - CONE |
| 6180 | 1 | Complete Centrifugal Clutch - CONE |
| 6200 | 1 | Bearing for Clutch Shoe - CONE |
| 6270 | 1 | Locknut for Brake Shoe Bearing - CONE |

MOUNTING WITH STUB PLANE




MOUNTING WITH CONE

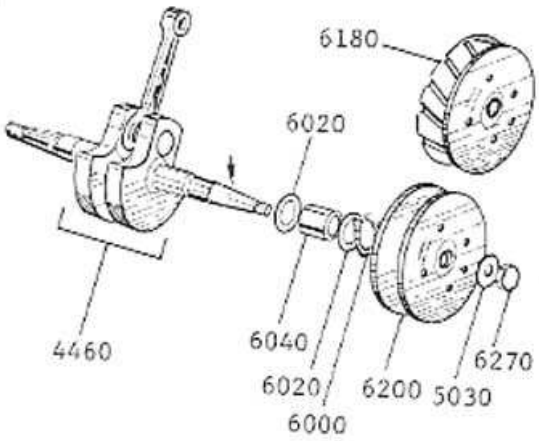
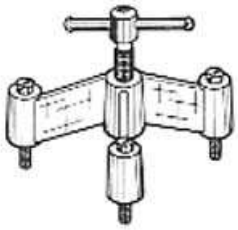


TABLE 3 – DEALER TOOL KIT FOR MINARELLI VI ENGINE

| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| 6900 | 1 | Point Timer |
| 6920 | 1 | Intermediate Sprocket Extractor |
| 6930 | 1 | Crankshaft Extractor |
| 6950 | 1 | Flywheel Puller (CEV Only) |
| 6960 | 1 | Sprocket Holding Tool |
| 6970 | 1 | Clutch Tool |
| 6980 | 1 | Clutch Puller |
| 6990 | 1 | Flywheel Tool |
| 1600 | 1 | Wrench for Cap Adjuster |
| 1610 | 1 | Wrench for Steering Lock Nut |

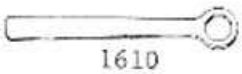

6930

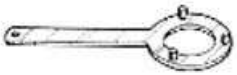
6980

6950

6920

6970


1610


6990

1600

6960

6900

OWNER TOOL KIT

| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| 1240 | 1 | Spark Plug Wrench |
| 1620 | 1 | Double End Wrench 10/17 mm |
| 1630 | 1 | Allen Wrench 5 mm |

1240

1630

1620

## MINARELLI: ELECTRICAL SYSTEM THEORY OF OPERATION

The C.E.V. Magneto used on the Minarelli engine consists of two basic components. First, the magneto contains a STATOR PLATE mounted on the left side engine housing. This STATOR PLATE holds the primary ignition coil, the lighting coil, the points, and the condensor. Secondly, there is a flywheel attached to the crankshaft and aligned by means of a Woodruff key. This flywheel or rotor contains four permanent magnets bonded to its outer rim. These magnets are equally spaced and the exact location is determined by the engine timing.

The primary ignition and lighting coils consist of enameled copper wire wound on a laminated iron core. This laminated core is magnetic in nature and allows for good magnetic permeability, yet keeps the Eddy Current losses low. The enamel on the copper wire is an electrical insulator that keeps the wire from shorting to itself, thereby allowing it to be wound into many turns over itself.

When a copper wire, known as a conductor, is cut by magnetic lines of force, a voltage is impressed in the conductor and current is forced to flow. In order that the conductors are cut by the lines of force, the magnets are mounted on the rotating flywheel. The voltage output of the coils is directly proportional to the speed of rotation and the load placed on them.

In the Minarelli engine the lighting coil has a voltage output of approximately 6 volts at 25 watts max load. The primary ignition coil puts out 12 volts at approximately 20 watts to be used for accessories, such as a stop light circuit. The primary ignition coil supplies the power to drive the external high tension coil as its primary function.

As the rotor turns, clockwise on the Minarelli engine, the points remain closed until the timing mark on the rotor lines up with the timing mark on the engine housing. While the points are closed all current is shunted to ground, and no ignition firing can occur. As soon as the timing marks coincide, the points crack open, and current is routed through the primary winding of the external high voltage coil to the ground. This causes a high voltage, approximately 15,000 volts, to be induced in the secondary winding of the external high tension coil. This voltage then appears across the 0.024 inch spark plug gap. The voltage is sufficient to jump this gap and the plug fires.

The condensor acts as the spark suppressor to keep the points from arcing when they open. It acts like a short circuit the moment the points open, but quickly becomes an open

-CONTINUED-

circuit to shunt the current to the external high tension coil.

The magneto, as described, has three outputs: the lighting circuit, the accessory circuit, and the ignition circuit. All the outputs are A.C. (alternating current). Any devices which require the charging of a battery off the magneto will require a rectifier to be placed in the circuit to change the current to D.C.

## TABLE 4 MAGNETO ⌀ 80mm—BOSCH MODEL KB6-B212 18w 6v

| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| 5140 | 5 | Washer, Ø4mm |
| 5900 | 1 | Inductor, (Rotor) |
| 5910 | 1 | Screw for Securing Points |
| 5920 | 1 | Points |
| 5930 | 4 | Screw for Securing Coils |
| 5940 | 1 | Capacitor (Condenser) |
| 5960 | 1 | Greasing Felt |
| 5970 | 1 | Coil, High Voltage for Ignition |
| 5980 | 1 | Coil, Low Voltage for Lights |
| 5990 | 1 | Stator, Ø80mm |
| 6010 | 1 | Stator, Complete Ø80mm |
| 6060 | 1 | Magneto, Complete |

NOTE: WHEN ORDERING MAGNETO PARTS, ALWAYS SPECIFY THE MAKE AND MODEL NUMBER PRINTED ON THE ROTOR.

BOSCH MODEL KB6-B212

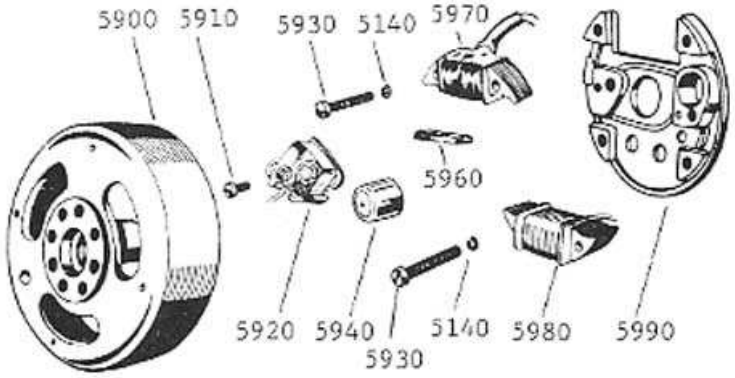
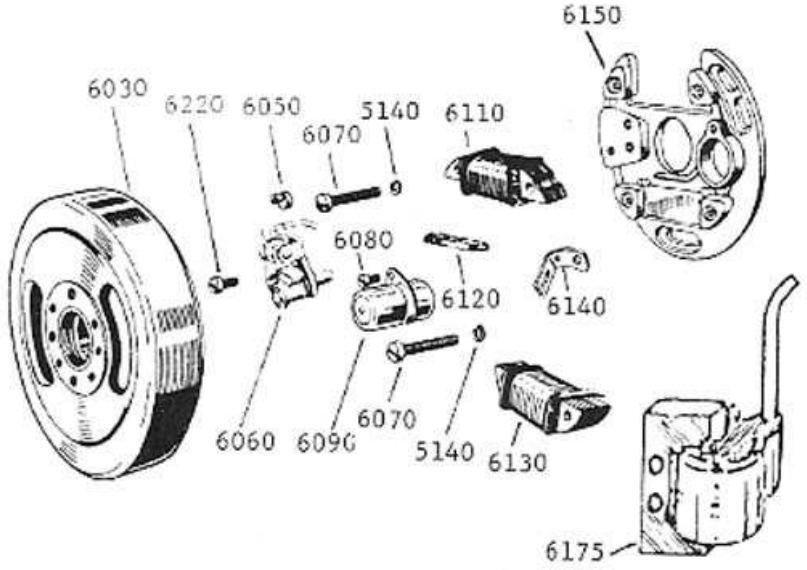


TABLE 5 – MAGNETO ϕ 94mm – CEV MODEL 6876 23w 6v



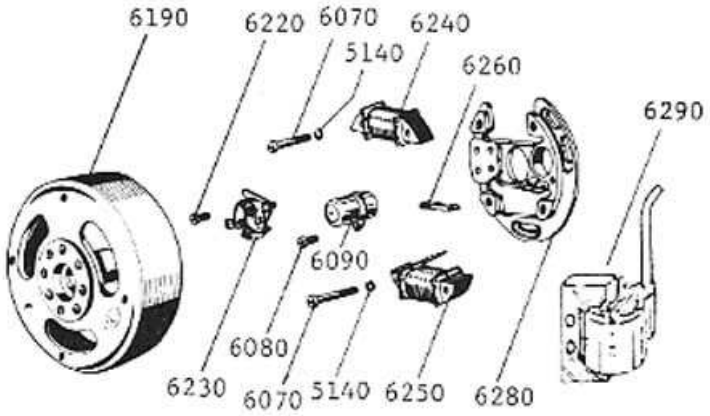

| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| 5140 | 4 | Washer, Ø4mm |
| 5340 | 1 | Magneto, Complete w/All Components |
| 6030 | 1 | Inductor (Rotor) |
| 6050 | 1 | Cam, Adjusting for Points |
| 6060 | 1 | Points |
| 6070 | 4 | Screw for Securing Coils |
| 6080 | 1 | Screw for Securing Capacitor |
| 6090 | 1 | Capacitor |
| 6110 | 1 | Coil, High Voltage for Ignition |
| 6120 | 1 | Greasing Felt |
| 6130 | 1 | Coil, Low Voltage for Lights |
| 6140 | 1 | Holder for Felt |
| 6150 | 1 | Stator, Ø94mm |
| 6160 | 1 | Stator, Complete |
| 6175 | 1 | Coil External High Voltage for Ignition |
| 6220 | 1 | Screw for Securing Points |

TABLE 6 – MAGNETO ϕ 80mm – CEV MODEL 6932 23w 6v

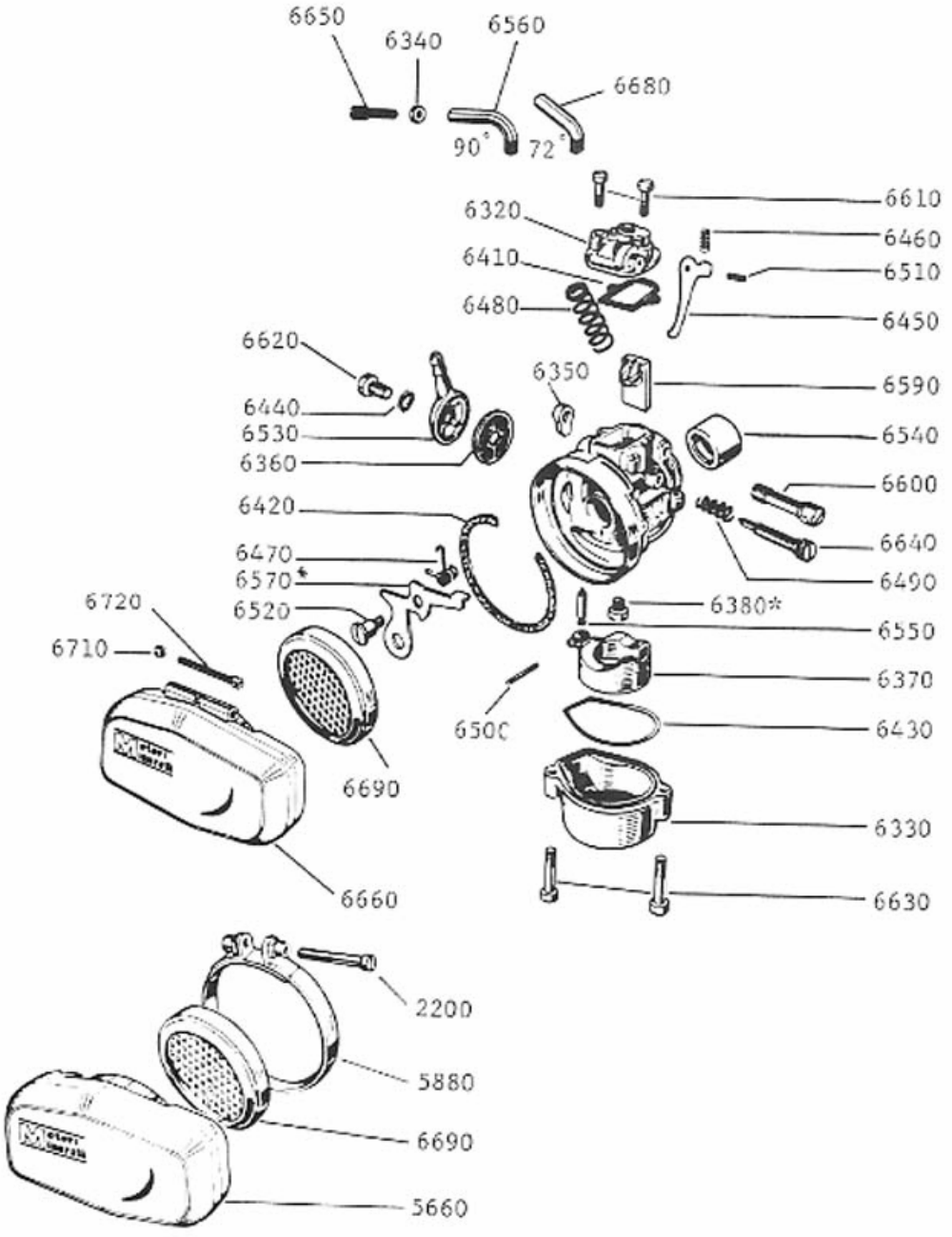
| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| 5140 | 4 | Washer, Ø4mm |
| 5360 | 1 | Magneto, Complete w/All Listed Components |
| 6070 | 4 | Screw for Securing Coils |
| 6080 | 1 | Screw for Securing Capacitor |
| 6090 | 1 | Capacitor |
| 6190 | 1 | Inductor (Rotor Flywheel) |
| 6220 | 1 | Screw for Securing Points |
| 6230 | 1 | Points |
| 6240 | 1 | Coil, Primary for Ignition |
| 6250 | 1 | Coil, Low Voltage for Lights 6V - 23W |
| 6260 | 1 | Greasing Felt |
| 6280 | 1 | Stator, Ø80 |
| 6290 | 1 | Coil, External High Voltage for Ignition (Black) |
| 6300 | 1 | Stator, Complete |

NOTE: WHEN ORDERING MAGNETO PARTS, ALWAYS SPECIFY THE MAKE AND MODEL NUMBER PRINTED ON THE ROTOR.

CEV MODEL 6932



## TABLE 7 DELL'ORTO CARBURETOR



## TABLE 7 DELL'ORTO CARBURETOR

| PART NO. | QUANTITY | DESCRIPTION |
|---|---|---|
| 2200 | 1 | Screw for Securing Clamp |
| 5660 | 1 | Housing for Air Filter |
| 5880 | 1 | Clamp for Air Filter Housing |
| 6320 | 1 | Cover for Mixture Chamber |
| 6330 | 1 | Float Bowl |
| 6340 | 1 | Locknut for Throttle Cable Adjuster |
| 6350 | 1 | Nut for Mounting Bolt |
| 6360 | 1 | Fuel Filter |
| 6370 | 1 | Float |
| 6379 | 1 | Jet #47 for 17mph |
| 6380* | 1 | Jet #49 for 20mph |
| 6390 | 1 | Jet #51 for 25/30mph above 2000 feet |
| 6400 | 1 | Jet #52 for 25/30mph |
| 6410 | 1 | Gasket for Mixture Chamber |
| 6420 | 1 | Gasket for Air Filter |
| 6430 | 1 | Gasket for Float Bowl |
| 6440 | 1 | Gasket for Fuel Intake Screw |
| 6450 | 1 | Choke Lock |
| 6460 | 1 | Spring for Choke Lock |
| 6470 | 1 | Return Spring for Choke |
| 6480 | 1 | Return Spring for Throttle Slide |
| 6490 | 1 | Spring for Idler Screw |
| 6500 | 1 | Pin for Float |
| 6510 | 1 | Pin for Choke Lock |
| 6520 | 1 | Screw for Securing Choke Arm |
| 6530 | 1 | Fuel Intake |
| 6540 | 1 | Gasket, Insulating |
| 6550 | 1 | Needle Valve |
| 6560 | 1 | Guide for Throttle Cable, Old |
| 6570* | 1 | Choke Arm, Short |
| 6580 | 1 | Choke Arm, Long |
| 6590 | 1 | Slide for Throttle |
| 6600 | 1 | Bolt for Securing Carburetor to Manifold |
| 6610 | 2 | Screw for Securing Mixture Chamber Cover |
| 6620 | 1 | Screw for Securing Fuel Intake |
| 6630 | 2 | Screw for Float Bowl |
| 6640 | 1 | Screw for Adjusting Idler |
| 6650 | 1 | Adjuster for Throttle Cable |
| 6660 | 1 | Housing for Air Filter, Self-supporting |
| 6680 | 1 | 72° Guide for Throttle Cable |
| 6690 | 1 | Filter Element, #6117 |
| 6710 | 1 | Nut for Housing Bolt |
| 6720 | 1 | Bolt for Securing Air Filter Housing |
| a5640 | 1 | Carburetor, SHA 14-9, Max. Jet #49 Dell'Orto for 20mph |
| a5650 | 1 | Carburetor, SHA 14-12, Max. Jet #52 Dell'Orto for 25/30mph |



* Multiple parts
a Found on engine drawing

# Minarelli Engine

Theory

## The Two-Stroke Engine

### ENGINE OPERATION

All Vl engines regardless of the top speed (17,20,25,30) are piston-port type two-strokes. The following discussion of each type will provide some insight into how they work and may someday prove very helpful in troubleshooting.

### PISTON PORT TWO-STROKE

The piston-port two-stroke is the simplest of all engines commonly seen in motorcycles and moped application. It has only three main moving parts and uses ports rather than valves, as in four stroke engines, to regulate intake and exhaust flow. These ports are all located in the cylinder wall and are opened and closed by the pistons movement. Their functions are:

Intake Port - Admits fresh fuel mixture from the carburetor into the crankcase.

Transfer Ports - Provide passages for the fuel mixture between the crankcase and combustion chamber.

Exhaust Port - Releases burnt gases from the combustion chamber into the exhaust pipe.

Basically with the Minarelli Vl engine this is what happens during a 360° rotation of the crank shaft beginning with the piston at top dead center:

1. Down Stroke

The piston descends from the previous cycle and exposes the exhaust port letting out the expanding burnt gases. Simultaneously, the piston's downward movement compresses the fuel mixture from the previous cycle occupying the airtight crankcase.

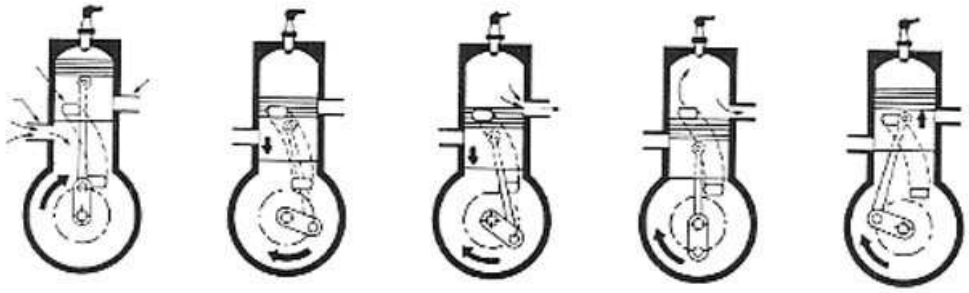
As the piston continues to descend, it also exposes the transfer ports. The compressed mixture waiting in the crankcase now rushes through the ports and fills the combustion chamber while at the same time sweeping any remaining burnt gases out the exhaust port.

2. Upstroke

After reaching its lowest point of travel, the piston begins to ascend and closes off the transfer ports. At the same time, the piston's upward movement creates a partial vacuum in the crankcase.

As the piston continues to ascend, it closes off the exhaust port and begins to compress the mixture in the combustion chamber. Meanwhile, the bottom of the piston exposes the intake port and a fresh fuel mixture is sucked into the crankcase. When the piston approaches top dead center, ignition occurs and the piston once again descends to begin another cycle.

As described, ignition occurs once every 360° or more appropriately, once every two strokes of the piston (one down and one up). Hence, the term two-stroke engine. (Time at 23° B.T.D.C.)

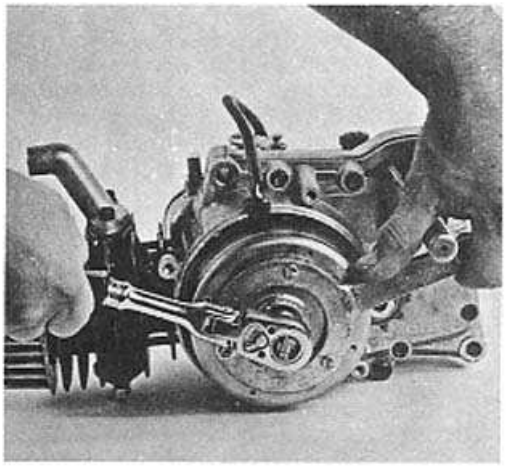


Please note that all steps up to #15 can be done with the engine mounted on the bike, although it is much easier to do it on your workbench.

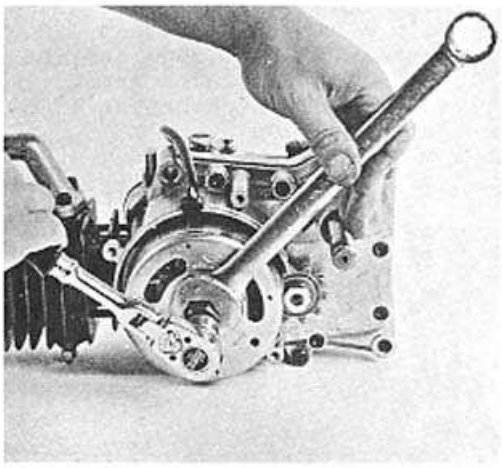
Remove air conveyor #5430 with 3 6x25 #5450 Allen bolts, and cooling fan with 4 Phillips screws to gain access to the magneto.

Please note that all threads on the Minarelli are right hand, with the exception of the threads in the left hand crank arm.

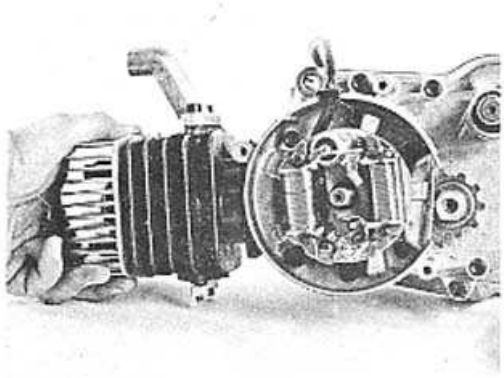
1. Using the special Minarelli flywheel tool #6990 to hold the magneto, and a 14mm socket, remove the nut from the center of the magneto.
NOTE: Be very careful not to scratch the 2 coils. They are clear enamel coated to insulate the wire, and can be ruined by scratching.



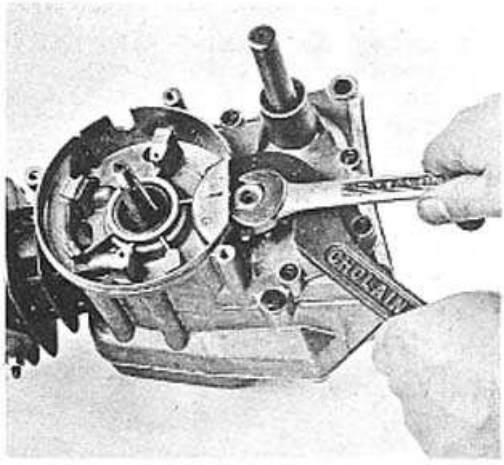
2. Insert the flywheel puller #6950 all the way into the center of the magneto. Hold the tool with a 20mm wrench and turn the extracting bolt with a 17mm wrench until a popping sound is heard.
NOTE: The magneto is on a tapered shaft with woodruff key. If the extractor bolt is extremely hard to turn, remove socket and rap extractor bolt smartly with plastic mallet.
NOTE: No other tool, such as a gear puller extractor, may be used to pull the magneto. It must be extracted only from the center threads or it will be warped.



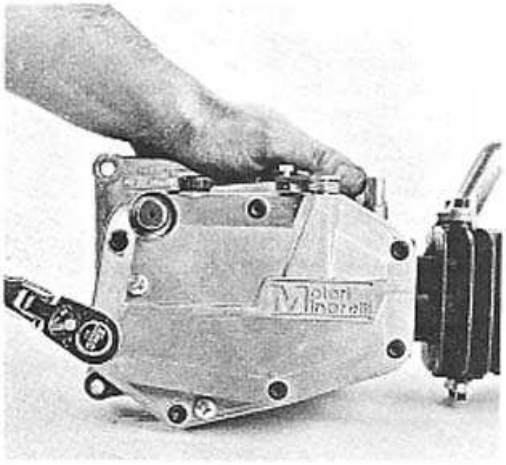
3. Scribe a line on the stator plate and the engine casing, marking it's position on the engine. Remove the two Phillips screws and lift out the stator plate.



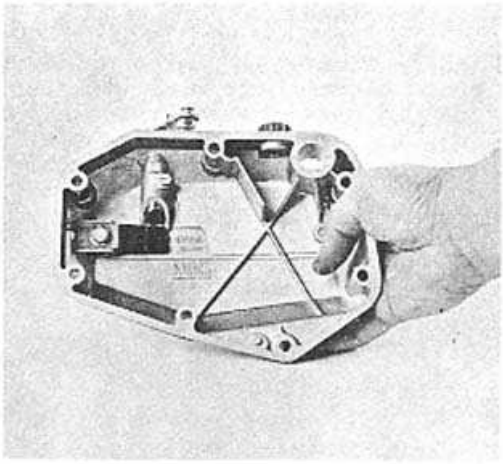
4. Using the Minarelli sprocket holding tool #6960 and a 17mm wrench, remove the sprocket nut and washer. The sprocket can be removed with two large screwdrivers being careful not to damage the cases.



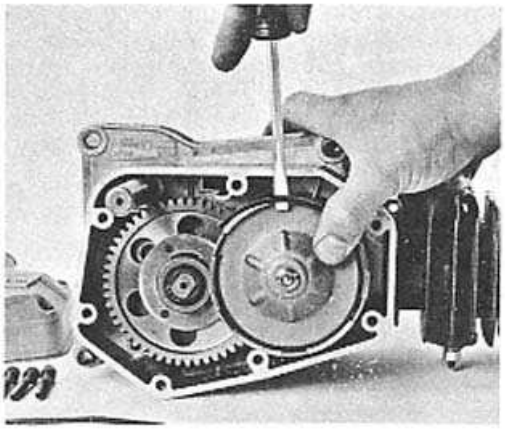
5. Drain the oil from the casing. With a 5mm Allen wrench, remove the six 6x35 #5330mm and the one 6x15 #5320mm clutch casing screws to remove clutch casing #5260 and gasket #5270.



6. The clutch cover contains lever for clutch arm #5100 and two spring leafs #5180 and #5190. If there is any noticeable wear on spring leafs, replace and note wearing on starter plate bearing opposite the spring leafs. NOTE: Starter arm may be removed by screw. This becomes necessary when the 8x10mm cable holder is broken.

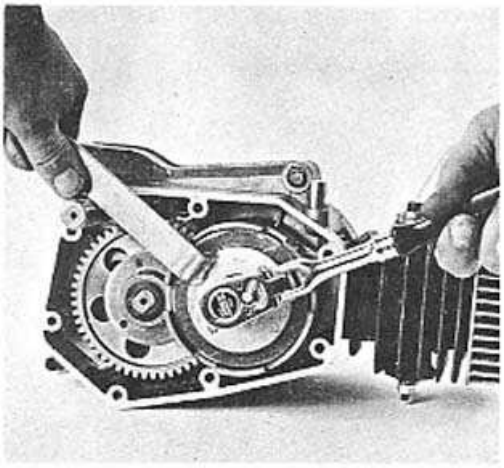


7. With a screwdriver, remove lock ring #5090 from hub. This will allow retainer cap #5080, retainer for cap return spring #5070, and cap return spring #5060 to be removed.

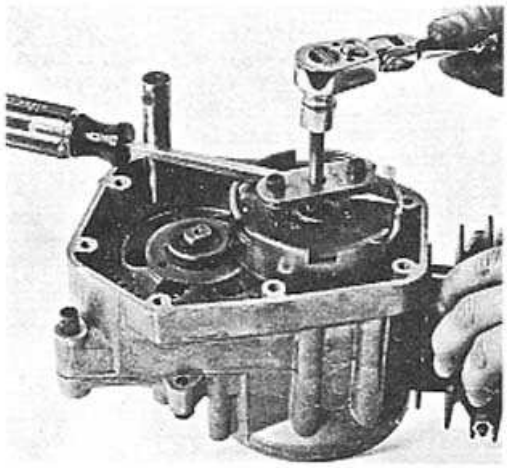


8. Using Minarelli clutch tool #6970 and a 13mm socket, remove clutch nut #6270 and washer #5030.

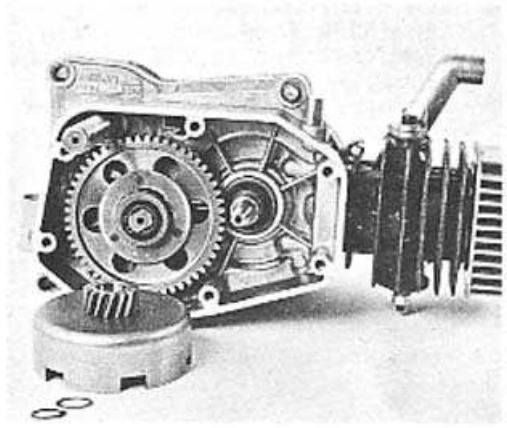
*Note new clutch.



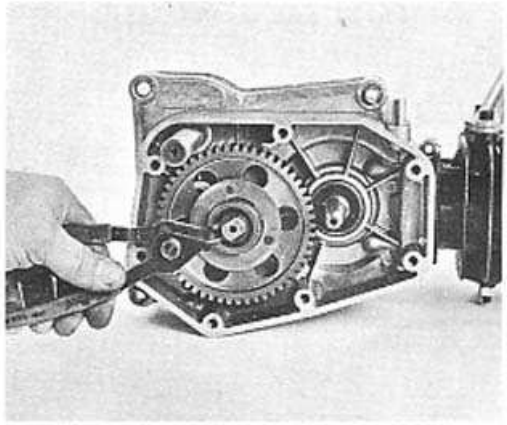
9. Screw Minarelli clutch puller screws into clutch body with tool #6980, making sure that they are all the way in. Insert long screwdriver through tool, resting it against the pedal shaft, and tighten the extracting bolt with a 13mm wrench. NOTE: Observe previous note on removing objects from tapered shafts.



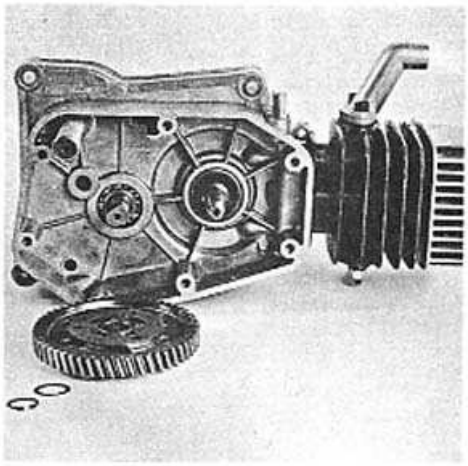
10. With a pair of snap ring pliers, remove snap ring #6000, shim 14x20mm #6020, and engine sprocket with housing #4900. You can now remove the brass clutch bushing #6040 and the remaining shim #6020 on the shaft.



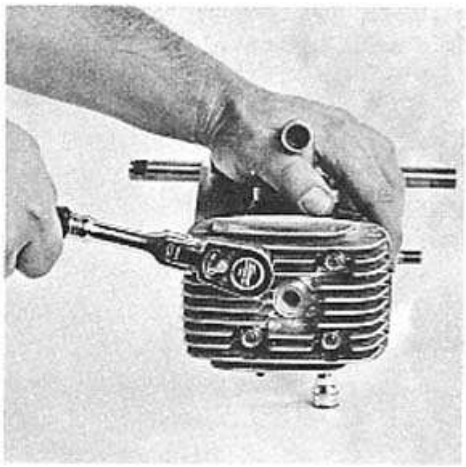
11. With snap ring pliers, remove snap ring #4860, shim #4850, and drive clutch #4870.



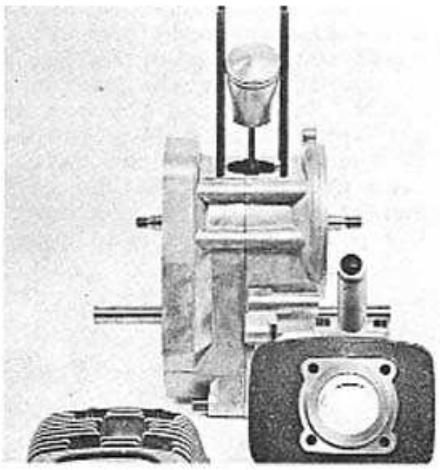
12. Remove snap ring #4860, washer #4850 and gear for clutch #4890 to complete clutch disassembly.



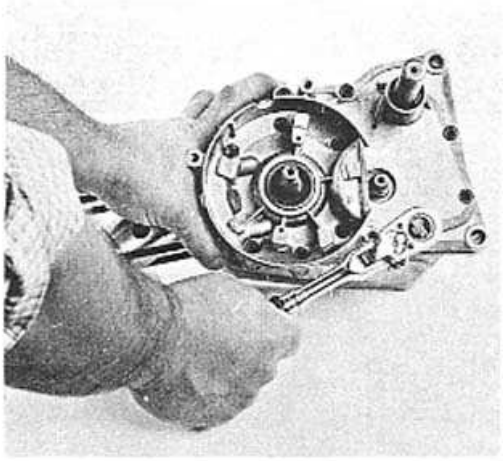
13. With a 10mm socket, remove the four #5550 nuts and four #5540 washers from the cylinder head.



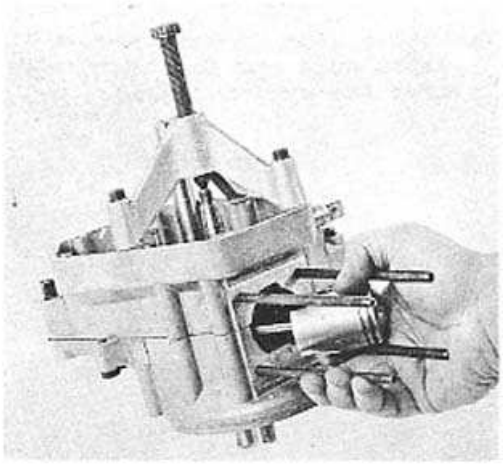
14. You can remove the cylinder head #5500, cylinder #5480 and base gasket #5460. Head gasket #5490 will stay in the cylinder head and may appear not to exist. It can be removed with a small screwdriver, but generally need not be replaced or removed. IF replaced, be sure to replace with same thickness as head gasket.



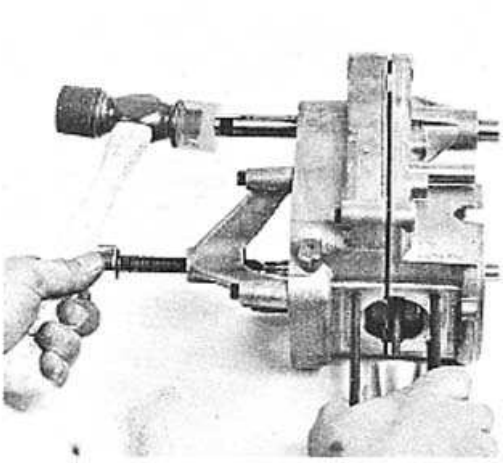
15. Remove the eleven #5250 6x30mm casing bolts from the magneto side of the engine cases.



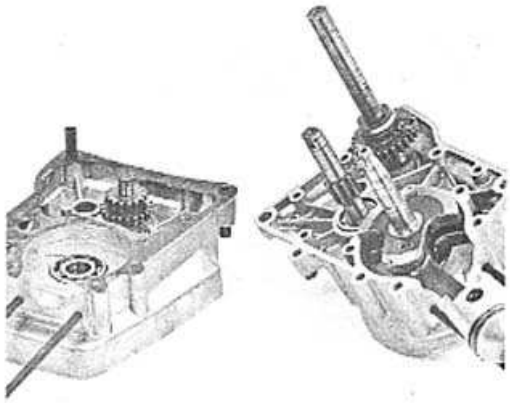
16. Install Minarelli crank shaft extractor #6930 with the three long special bolts provided with the extractor.



17. Tighten the crankshaft extractor and simultaneously tap the pedal shaft with a rubber mallet in order to evenly split the engine cases. NOTE: Tightening the crankshaft extractor tool only will result in the top end of the cases splitting at an angle to the bottom end of the cases. You must tap the pedal shaft for an even extraction.



**18.** With cases split you have access to all internal gears and shims.
NOTE: 1. Crank should be replaced as a whole unit (#4460).
2. Idler pin #5720 can be removed from the engine cases.
3. Spring #5770 can be removed from pedal clutch gear #5760.
4. Lock ring #5800 removes shim #5790 and pedal gear #5750 from the pedal shaft #5740.



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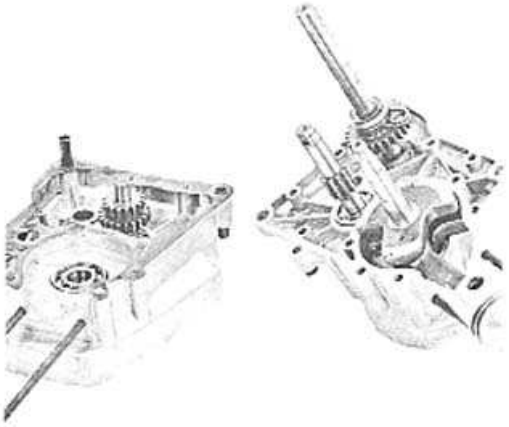
**19.** NOTE: 1. Keyed side of crank goes into magneto housing and will have a shim on it.
2. The flat side of the drive gears goes toward the magneto side, and may have a shim on it also.
3. The small gear of the idler gear #5710 faces the magneto side of the engine cases with shim #5730 on each side.



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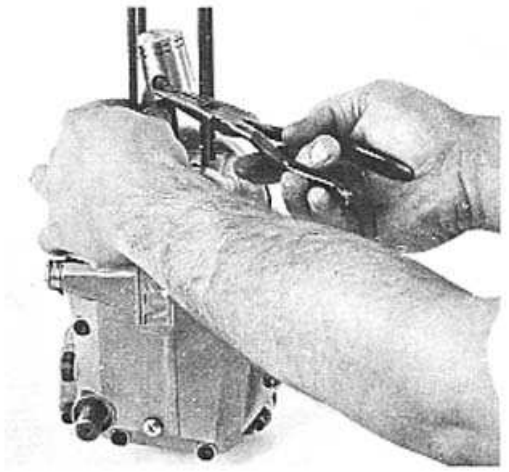
**20.** Remove G clips from piston #4490 with needle nose pliers.
NOTE: When not expecting to split case (e.g., decarbonization), always put a rag or paper towel in the top end of the cases under the piston to avoid dropping any clips, dirt, or broken ring parts into the cases of the engine, which would force an unneccessary splitting of the cases.



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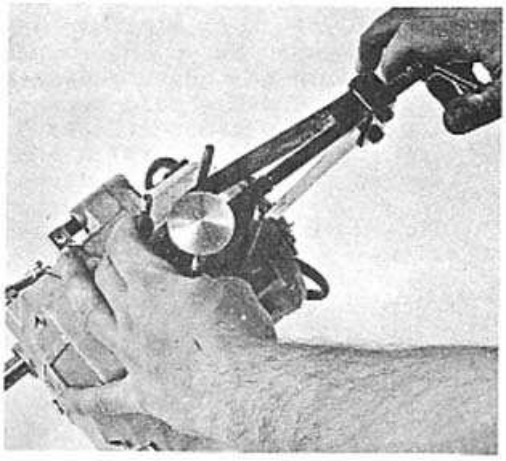
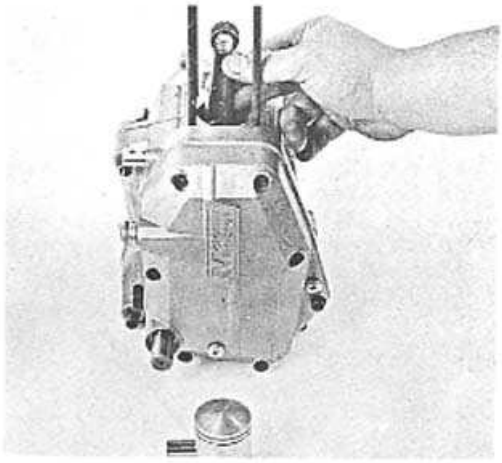
21. Using a piston pin extractor, press the piston pin #4480 about 3/4 of the way through the piston. Remove tool and lift piston off of connecting rod.
NOTE: Rings should be removed before piston pin extractor is installed, or rings should be lined up with brass pins, so that they will not break up on extraction of the pin.



22. If the brass bushing in the connecting rod needs to be replaced, you must first remove the old brass bushing #4470, install the new bushing, ream it out 1mm (see Technical Bulletin #004), and drill the three holes needed in the connecting rod to provide lubrication to the sleeve and piston pin.
NOTE: This step will require splitting of the cases in order to properly drill the bottom two holes in the connecting rod of assembly #4460.

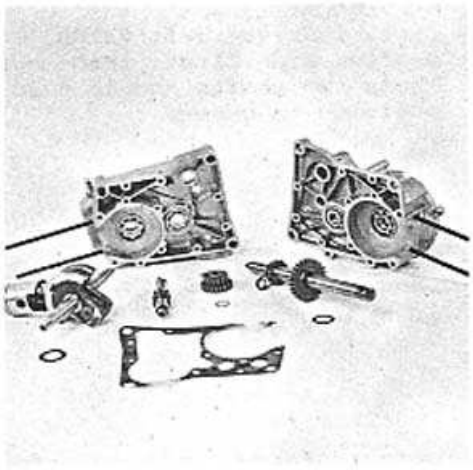


## ASSEMBLY OF MINARELLI ENGINE

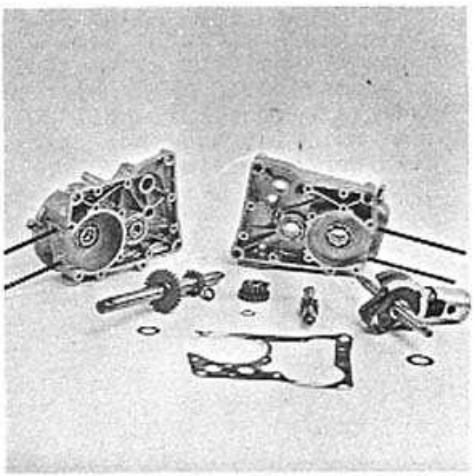
NOTE: When reassembling the Minarelli engine, replace all seals and gaskets. All parts removed and to be reused should be thoroughly cleaned and lightly oiled. All gaskets should be given a light coat of grease to help you seat them into place and also to insure a better seal.

NOTE: All shims used in the Minarelli fit properly on the shafts. As shafts are of different diameters, a loose fitting shim is improperly placed. Placing the wrong thickness shim on shaft will either allow a loose fit if too thin, or not allow snap ring to fit on if too thick.

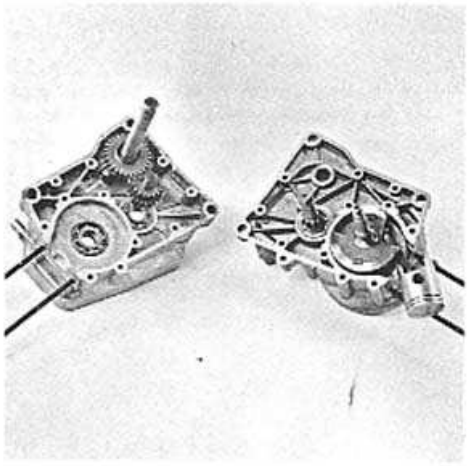
Install idler shim #5730, idler gear #5710, and shim #5730 on to idler shaft which should be on the clutch side.
If piston was extracted from connecting rod, reassemble at this time. Install one G-clip and push in piston with piston pin extractor. Install second G-clip, making sure there is sufficient clearance.



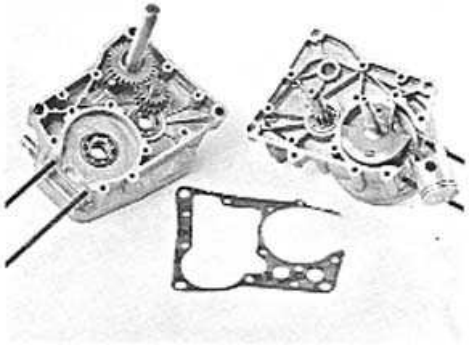
Install pedal shaft into clutch side of casing with shim #5790, pedal clutch #5760, with spring on it, pedal gear #5750, shim #5790, and snap ring #5800, which should be installed on pedal shaft previous to insertion in the case. Then put on final shim #5790 on shaft next to snap ring.
NOTE: Make sure that "S" or ➡ on piston points to exhaust side of cylinder. If no mark appears, install piston so that pins for piston rings face exhaust port.



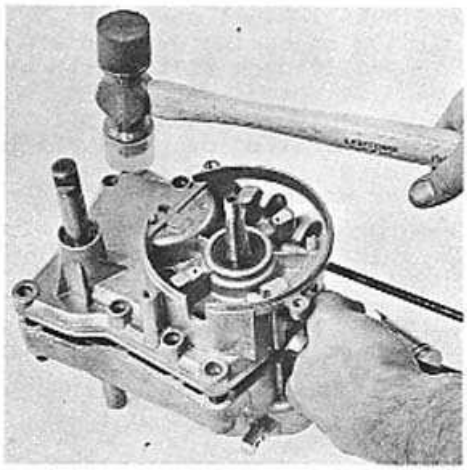
In magneto side, install crank #4460 (shim goes between crank and cases on this side).



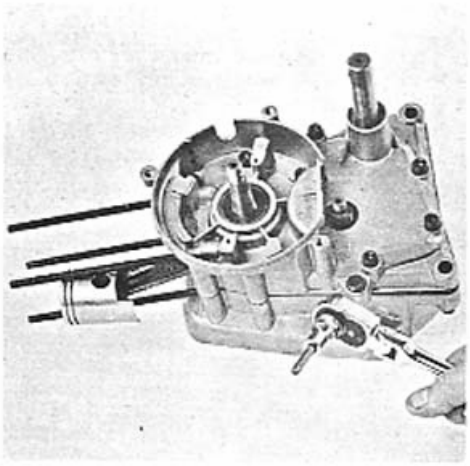
Install drive shaft #4760 (with shim), shafted side first, into magneto side These two shafts should hold their position in cases.



Place gasket and casing on clutch side, placing clutch side up. Place magneto side with drive shaft #4760 and crank #4460 on to clutch side and press together until all shafts line up. Tap together carefully with rubber mallet.



With 5mm Allen wrench, draw cases together slowly until snug. Tighten the six bolts in the magneto housing in a criss-cross fashion first. Then tighten the five remaining casing bolts starting from the lower part of the engine. Torque to 8.0 ft.lb. torque. Double check all bolts with a torque wrench. At this point make sure all shafts spin freely. There should be no play in any shaft at all.



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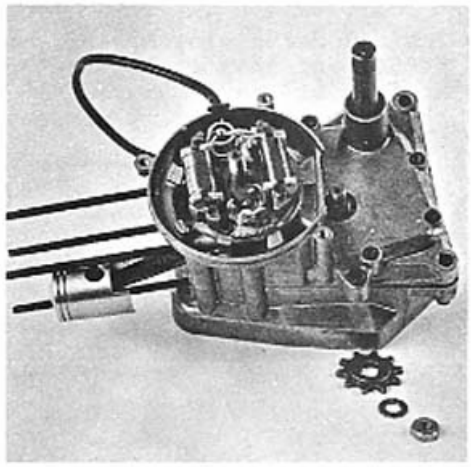
Place Woodruff key in its position on Magneto side of crankshaft. Install stator plate, using the two Phillips head screws #4740, making sure that scribe marks line up.



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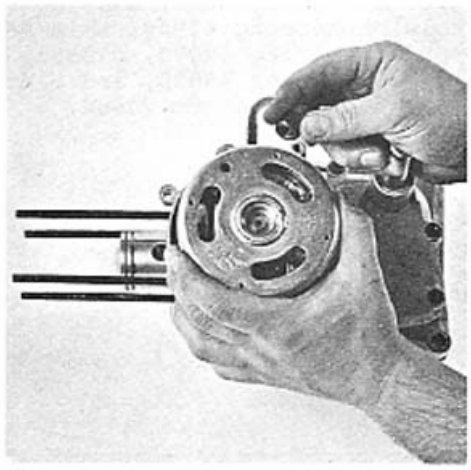
Mount the flywheel #6190, making sure that Woodruff key is positioned correctly in keyway. Install flywheel nut, and with the flywheel holding tool #6990 and 14mm socket, torque to 34 ft.lb.



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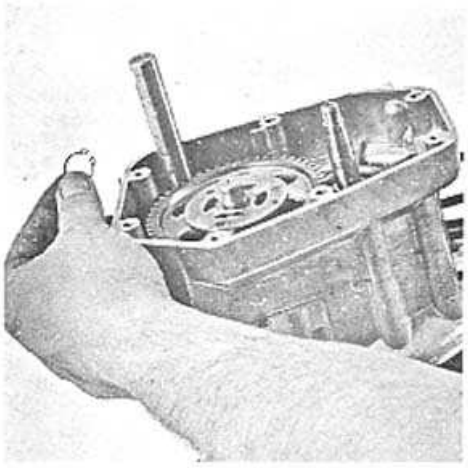
Install clutch gear #4890, washer #4850, and snap ring #4860 on rear drive sprocket.
NOTE: Larger diameter shim for this shaft fits on outside of drive.



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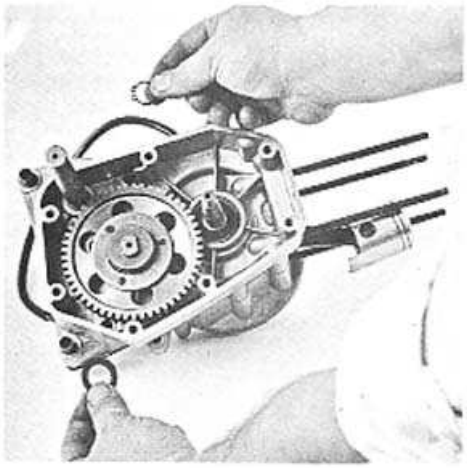
Install drive clutch #4870, shim #4850, and snap ring #4860 on shaft. All parts should fit on shafts with virtually no play.



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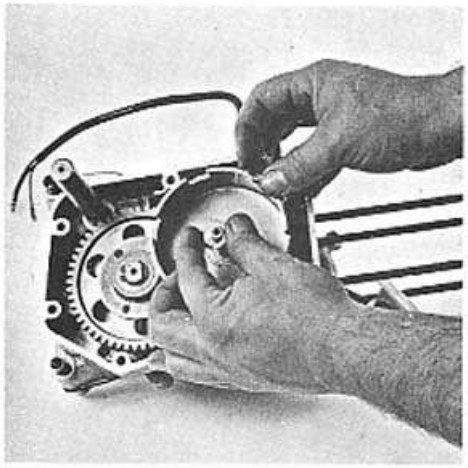
Install shim #6020, bushing #6040, clutch housing #4900, shim #6020, and snap ring #6000, cluster body #6180, washer #5030, and clutch nut #5040 on shaft #4460.



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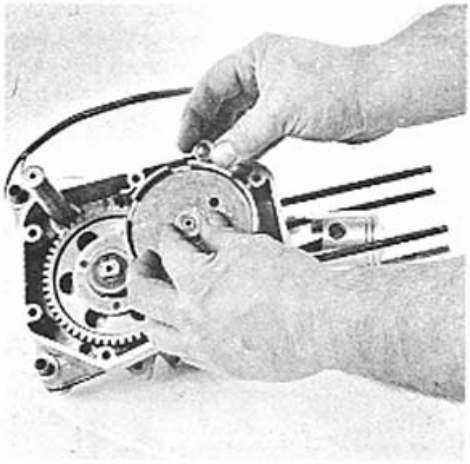
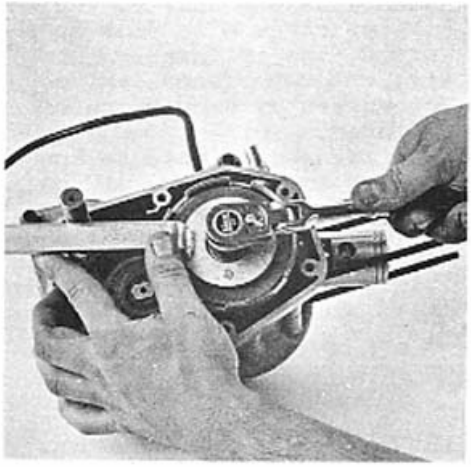
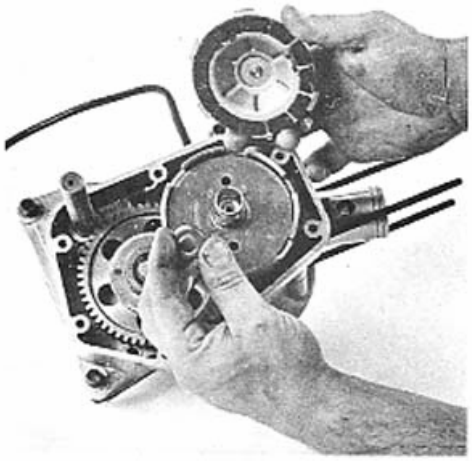
Install clutch body #6180, washer #5030, and clutch nut #5040 on shaft.



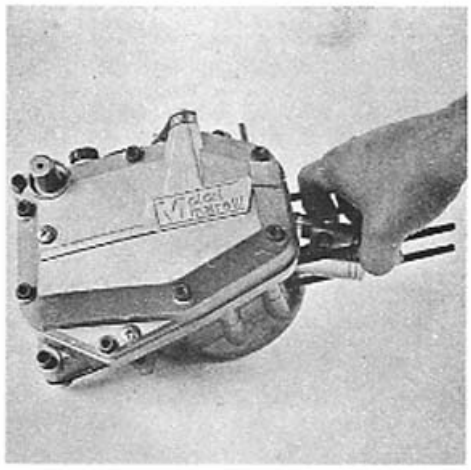
With Minarelli clutch tool #6970, hold clutch body and torque nut to 21.7 ft.lb.



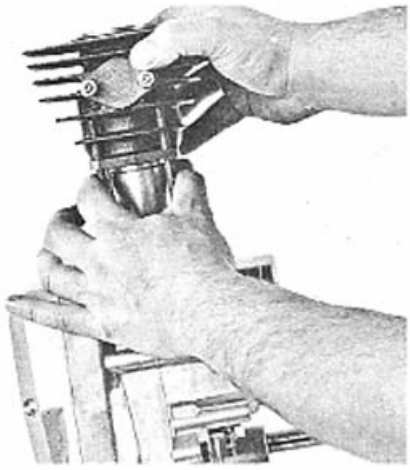
Install spring #5060, retainer cap for spring #5070, retainer cap #5080 and press into housing, lining up retainer with housing in slots. Install lock ring #5090 into groove, and check retaining cap for starter for proper movement, which is approximately 1mm in and out.



Install clutch cover gasket #5240 and clutch housing #5260 with the six 6x15mm and one 6x35mm Allen bolts. Torque clutch casing bolts to 8.0 ft.lb.



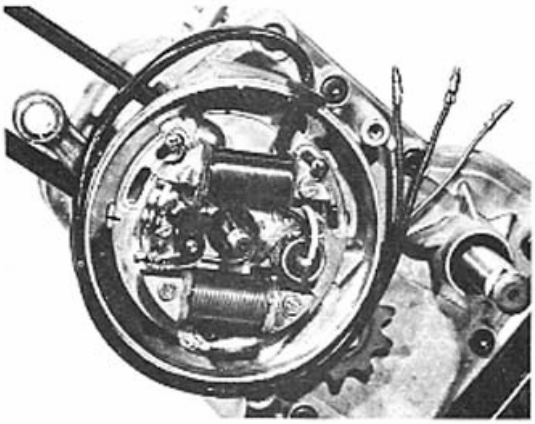
Install base gasket on engine casing. Line up rings with pins on piston, so that the cylinder can be installed over piston. Rings can be compressed by hand to enter the cylinder.
Turn magneto to observe smooth and even movement of the piston.
NOTE: The tolerance between cylinder and piston should be 0.003in. to 0.005in. (.080-.085mm.).
NOTE: Cylinder should be lightly oiled previous to installation.



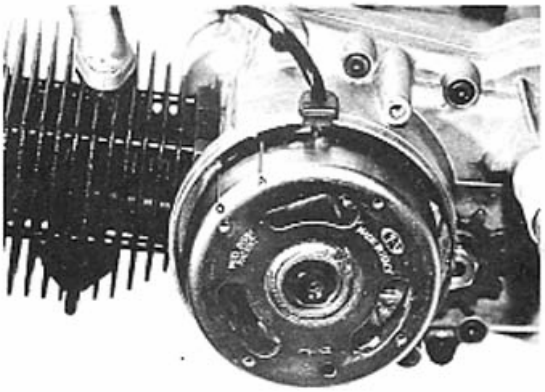
Install head gasket #5490 and cylinder head #5500, four washers and 10mm nuts. Tighten cylinder head nuts in a criss-cross pattern and torque them to 8.0 ft.lb.

## TIMING ENGINE

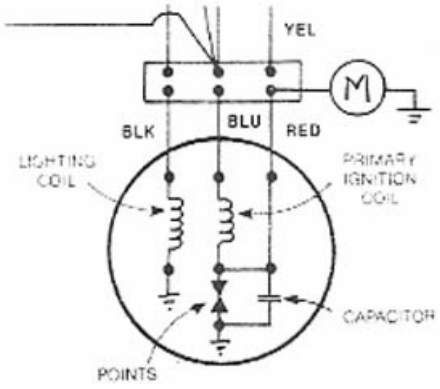
Rotate the flywheel by hand in a clockwise direction until points are fully open. Check point gap and, if neccessary, reset point gap, which should be 0.014in. to 0.018in (0.35-0.40mm).
NOTE: The correct point gap setting is essential before the ignition timing operation can be carried out.
NOTE: It is better to set the points at 0.018in, as the points wear together and will remain in area of correct adjustment longer.



To set timing, rotate the magneto flywheel in a clockwise direction (note arrow on flywheel) until the first line on the flywheel aligns with the arrow on the casing. This position is 23 degrees before top dead center. The points should just start to open at this alignment.

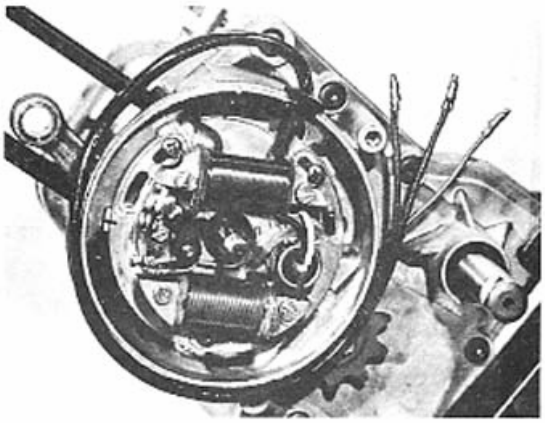


Proper alignment can be checked by removing the blue wire from any ground and connecting the red wire to a continuity tester (e.g., buzz box, multi-meter, etc.) and to ground.



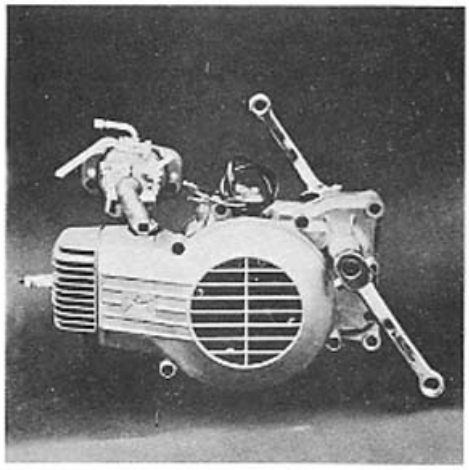
MAGNETO

To adjust the stator plate loosen the two phillips screws and move the plate counter-clockwise if to far advanced and clockwise if retarded. Retighten screws and re-check timing. Note: If opening occurs before the mark lines up the timing is said to be advanced. Note: The second line on the magneto flywheel is top dead center.



Place chain sprocket on shaft, replace washer and 17mm nut, and tighten, holding the sprocket with tool #6960. Torque to 32.0 ft.lbs.

Replace fan housing with four phillips screws, fan, and fancover with three allen bolts, in that order. Remount engine to frame, mount carburetor with intake pipe, install spark plug, refill engine with SAE 20 W non-detergent oil only.
NOTE: Middle phillips screw in casing is correct oil level.

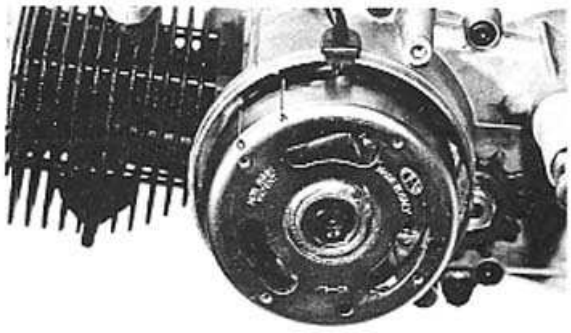


TECHNICAL BULLETIN

Timing the Minarelli V1 Engine

1. Remove left footrest.
2. Remove air conveyor (5430).
3. Remove fan (5410).
4. For convenience remove bearing for conveyor (5390).
5. Rotate flywheel by hand in a clockwise direction until points are fully open; check gap and if necessary, reset point gap which should be .014 to .018 (0.35 to 0.40mm).

NOTE: The correct point gap setting is essential before the ignition timing operation can be carried out.



NOTE: (O) is top dead center - (A) is 23° degrees before top dead center.

6. Remove blue and red wires from connector located above magneto.

7. Connect continuity checker (buzz box, bulb and battery or resistance scale of meter) between red wire and case of engine. NOTE: Leave blue wire free.

8. Slowly move the flywheel by hand clockwise and observe the position of mark (A) on flywheel in relation to scribe mark on case, when the points open (loss of continuity indicated by checking device) the timing will be correct when the two marks line up.

NOTE: If the opening of the points occur before (advanced) or after (retarded) the marks line up, the stator plate will have to be adjusted.

A. To adjust stator place, it will be necessary to remove the flywheel.

B. Slacken the screws securing the stator plate and move the plate in the required direction.
If advanced move stator plate counterclockwise.
If retarded move stator plate clockwise.

c. Retighten all screws and reassemble side of engine.

NOTE: Be sure to tighten magneto check nut securely.

## Technical Data

ENGINE

* Model - Minarelli VI
* Single Cylinder 2 stroke
* Cubic Capacity:
  47.6 cc - 20 mph
  49.4 cc - 25 and 30 mph
* Bore:
  38.0 mm - 20 mph
  38.8 mm - 25 and 30 mph
* Stroke: 42.0 mm
* Compression Ratio: 8 to 1
* Horsepower @ 4800 rpm:
  1.00 - 20 mph
  1.90 - 25 and 30 mph
* Piston to wall clearance - .0025" - .005"
  rebore at .002" clearance
* Ring Gap - .012"
* Ignition and Lighting:
  Flywheel 6-volt magneto with 23 watt capacity and external high tension coil stop light operated by grounding of low tension ignition coil.
* Fuel Mixture: Minarelli synthetic oil, 64 to 1
  Synthetic oil - 40 to 1 mixture, of recomended ratio on can. or

* Starting: Pedal and Clutch
* Clutch: Automatic centrifugal expanding, running in oil
* Lubrication (Clutch and Gears) Capacity: 1 pint SAE 20 oil

PRIMARY TRANSMISSION

* Final reduction of 3.533 to 1 clutch gear: 15 - tooth; secondary gear: 52 - tooth

FINAL TRANSMISSION AND RATIO

* Driven by single row chain 1/2 x 3/16; 11-tooth engine sprocket to 42-tooth wheel sprocket ratio: 2.73 to 1

IGNITION TIMING

* 23° B.T.D.C. (measure on flywheel external diameter) or .079 B.T.D.C.

CONTACT BREAKER GAP

* .014 to .018 inches (.35 to .40 mm)

SPARK PLUGS

* BOSCH W 145 TI Gap: .024 inches
* Marelli CW 5H
* Champion L86, L89CM
* NKG - B5HS - cold weather, B6HS - warm weather

TORQUE

| | KG/MT | Foot/Pounds |
|---|---|---|
| Set screw for clutch lever (5130) | .18-.20 | 1.3-1.5 |
| Half-casing and side cover bolts | 1.0-1.2 | 7.3-8.7 |
| Intake manifold bolts (5610) | 1.0-1.1 | 7.3-8.0 |
| Oil level and drain screws | 0.5-0.6 | 3.6-4.3 |
| Bolt for securing spring leaves (5840) | 1.0-1.1 | 7.3-8.0 |
| Nuts for securing head (5550) | 1.0-1.2 | 7.3-8.7 |
| Nut for securing intermediate sprocket (4840) | 4.4-4.5 | 31.8-32.6 |
| Checknut for magneto flywheel (4750) | 4.6-4.8 | 33.3-34.7 |
| Checknut for securing centrifugal clutch with cone coupling (6270) | 3.0 | 21.7 |